- I give you a new GAME program on the calculator
- I claim that the winning percent is 45%
- You take a sample of 50 plays and find that you only win 15 times $\hat{p} = 15/50 = 30\%$
- Do you believe my claim? (that the winning percent is 45%) NO

- What if you got 19 wins? Would you believe my claim? $\hat{p} = 0.38$ maybe

- What if you got 21 wins? Would you believe me? $\hat{p} = 42\%$ YES

Hypothesis Tests (aka Tests of Significance)

* Used to test a claim about a population, using a sample.

* Checks hypothesized population parameter using a sample statistic

$\mu = 63''$

$\bar{x} =$ ~~[illegible]~~

* 4 parts:
  * HYPOTHESES
  * CONDITIONS
  * MECHANICS (work/calculations)
  * CONCLUSION (sentences)

$62''$

1- HYPOTHESES:

* **NULL HYPOTHESIS:** specifies the claim for the population parameter of interest
  * FORM: Ho: parameter = claim #
  * Read as "H not" or "H-O"
  * Assumed to be true
  * We can conclude to reject or fail to reject the claim

For a 1- proportion sample:

Ho: p = claim $\quad H_0: p = 0.45 \quad H_0: \mu = 63$

* **ALTERNATIVE HYPOTHESIS:** specifies the value of the parameter that we (the researchers) believe is true, or hope to find evidence for.

  * FORM: Ha: parameter $\begin{pmatrix} < \\ > \\ \neq \end{pmatrix}$ claim

$H_0: \mu = 63$

$H_a: \mu > 63$

$\neq$ ← changed different

For a 1- proportion sample:

Ha: p $\begin{pmatrix} < \\ > \\ \neq \end{pmatrix}$ claim

$H_0: p = 0.45$

$H_a: p < 0.45$

2- CONDITIONS:

* State & check conditions, then state the model & test used

* For 1-proportin samples, the conditions are:
  * Random sample (SRS)
  * np ≥ 10
    nq ≥ 10
  * pop ≥ 10*n*

NOTE: use p, because we have a value (the claim)

$H_0: p = 0.45 \quad \hat{p} = 0.30$

* Once all conditions met, we can use the Normal model for the 1-Proportion Z-Test

$$N\left(p, \sqrt{\frac{p \bullet q}{n}}\right)$$

3- MECHANICS:

* All calculations done here

TEST STATISTIC: Standardizing the sample statistic.

$$\text{Test stat} = \frac{\text{statistic - parameter}}{\text{std. error of statistic}}$$

(on formula sheet)

For 1-Proportion samples: Z-score

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p \bullet q}{n}}}$$

MORE MECHANICS...

P-VALUE:

The probability of getting our sample statistic (or something more extreme) if the claim is true.

* Use the test statistic (Z) to calculate, and symbol in Ha

P(Z $\gtrless$ test statistic) = normalcdf(LB, UB, 0, 1)

Ha	P-value
p < claim	P(Z < test stat)
p > claim	P(Z > test stat)
p ≠ claim	2*P(Z > |test stat|)

4- **CONCLUSION:**

NOTE: If P-Value is very small, we DO NOT believe our claim.

TWO CHOICES:

1) Reject the Ho because the P-value is very small
2) Fail to reject Ho because the P-value is not that small

How small is small enough??

* We compare the p-value to a number, called the *SIGNIFICANCE LEVEL*

- symbol: alpha = α
- Usually 0.01, 0.05, or 0.10

* If P-Value is **below** this level, we think it is small enough to **reject** the Ho.

CONCLUSION (cont'd):

Writing the conclusions: ALWAYS 2 SENTENCES!

* We:

- reject the Ho b/c the P-value of ____ < α = _____.

OR - fail to reject the Ho b/c the P-value of ____ > α = ____.

* We have:

- sufficient evidence for the Ha OR
- insufficient evidence for the Ha

(in context)

EXAMPLE: It is generally believed that about 12% of children are nearsighted. A random sample of 150 children from a local school district is taken and 21 are found to be nearsighted. Does this show evidence that the school district has a higher percentage of nearsightedness than the national average?

EXAMPLE: A 1996 report stated that 90% all American homes have at least one smoke detector. A city's fire dept. has been running a public safety campaign, and wonders if this effort has increased the percentage of smoke detectors in homes. So building inspectors visit 400 randomly selected homes and find that 376 of them have smoke detectors. Is this strong evidence that the local rate is higher than the national rate?

EXAMPLE: The percent of male births has been claimed to be 52% in the US. There has been some changes in prenatal care over the past 10years, and we are wondering if the percent of male births has changed. We took a random sample of 550 births and found that 56.9% of them were male. Test the claim.